New Analyses of Excavated Prehistoric Glass from Borneo

Received 23 September 1966

TOM HARRISSON*

Background and Problems

In an earlier paper I have argued, from the basis of glass-bead analyses in various parts of the Malaysia region, that there are at least two probable, or at least possible, ancient overseas sources of glass that was brought to Borneo and elsewhere—one from the west and possibly another from the north or northwest (Harrisson 1964: 50). Further than those two possibilities, all is obscure. The situation, as Alastair Lamb has further pointed out, remains complicated (Lamb 1965: 30). However, it is painfully clear that we cannot accept eye judgments on the content—and therefore the original composition and source—of the monochrome beads, which overwhelmingly outnumber all other sorts in Southeast Asia.

Yet, such eye judgments continue to be made, even in scholarly circles, as I have pointed out previously (Harrisson 1965: 153). In that article, I criticized an archaeologist who interestingly related beads to radiocarbon dates; but while accepting this objective scientific set of criteria for measuring the time scale, he failed to provide a single bead analysis for composition-manufacture at the same level of value—relying instead on subjective eye judgment to classify his properly dated beads as "Indian," etc. Some innocent mistakes have been serious, even laughable, such as the acceptance of Grecian glass from a neolithic site in Malaya. Nevertheless, though they are eventually discredited, new books on Malaysia and elsewhere continue to use the magic of such "culture diffusion."

On the other hand, we cannot expect scientific analysis to solve our source questions simply, any more than carbon dating alone can answer anything significant in archaeological stratification. Indeed, the application of regular, rigid, complete analytical methods to prehistoric glasses may at first produce more headaches than hoorays, in the hodge-podge of material cultures which, since Late Stone Age, ricocheted in, out, over, and around Malaysia, Indonesia, Indochina and the Philippines. Only when we have much data, firmly tied to glass with known and demonstrable time and place associations, can we expect to get clear answers. If, meanwhile, we do not decide answers in advance and try instead to test points

* Senior research associate, Department of Anthropology, Cornell University, and emeritus curator, Sarawak Museum, Kuching, Malaysia.

objectively, there is a better chance of keeping the resulting returns of factual data within bounds and avoiding chaos.

Here it is salutary to quote a recent reviewer, R. Organ (1965), commenting on Dr. Earle Caley's new study "Orchalicum and Related Ancient Alloys" (American Numismatic Society, New York, 1965). He writes (my italics):

> Chemical analysis having any pretence to precision makes use of considerable manpower and in the museum laboratory the effort cannot often be seen to be profitable compared with expenditure of comparable manpower directly on the cleaning or conservation of antiquities. Nevertheless, scientist and curator alike, we all have the instinctive feeling that analysis ought to be useful in solving problems of provenance. We therefore feel deflated when on comparing a new, hardly acquired analysis with figures reported from other sources we find that the comparison is in fact *inconclusive*. Responsibility for our deflation may rest with ourselves, because we have been insufficiently precise in our analysis or in our sampling. On the other hand, *the comparison analyses themselves may be faulty*, either because they have been inaccurate or because they have been made on objects of uncertain origin.

This paper is a minor exercise in shading between the lines sketched but left unfilled by the initial Malaysia studies mentioned above, but from one specific angle (to be described below).

In this instance, deep thanks are owing to Roy Perrot, H. Brill, and the staff at Corning Glass Museum, New York, for much difficult work on the glass objects under discussion. I have benefitted from two visits to and lengthy discussions—before and after the tests—at Corning in company of S. J. O'Connor of Cornell University, who shares an Asian interest in this subject (cf. O'Connor 1965: 562).

I will present a list of the sample materials, followed by the analyses of them as reported from Corning. The sample was chosen by me (on subjective eye-criteria) to test various existing but generally still rather vague ideas by objective means (see "Descriptions of Specimens" below). I should add that these analyses by Perrot and Brill are more detailed and complete than any data previously published for Southeast Asia. They cover a range of relatively rare but potentially significant trace elements and compounds, as well as the better-known glass materials. We have here not only barium but antimony, cobalt, stronthium, zirconium, silver, zinc, boron, bismuth, and vinadium, rarely or never before reported in excavated or other glass for this part of the world. Indeed, this very detail has raised some methodological and other points that involve further study—in part for reasons indicated in R. Organ's review cited above. With this necessary qualification, the sample is offered with some confidence.

Purpose of this Special Sample

It seemed to me we were in danger of getting too many analyses over too wide a spectrum of glass problems; and sometimes the analyses were executed rather hastily or incompletely —without strict regard to good laboratory technique. To avoid data diffusion and subsequent confusion, the material now under review was subject to three selective criteria—designed to restrict the problems and focus on one aspect as fully as possible. The plan was to pursue this kind of approach further in the future, rather than to stab at this still huge problem from all angles at once.

The three selective criteria employed were:

1. All but two (A. 1 and A. 2) of the pieces sampled were obtained in West Borneo by orderly archaeological excavation: that is, we knew where, how, and when each was found, and in what prehistorical associations. Thus, we excluded one of the main variables that exists when glass is picked up in random finds or out of unclassified collections.
2. The pieces sampled with one exception (A. 12) cover only a narrow range of the glass available for study, selected as being *optically alike* or closely similar, from monochrome blue or green glass of a very common "type" in the area. No other colors or combinations were included. This restricts the variables so especially due to coloring matter and also provides a check test for visual criteria over a rather narrow field.
3. The whole sample was tested under the rigid standards of the world's foremost Glass Museum and Laboratory, Corning, New York.

DESCRIPTION OF SPECIMENS

A. *Beads*

A.1 A dark blue bead in use in Kelabit uplands and regarded there as ancient. Included in series to test specimens from the same source—and the same necklace—separately and previously tested in Malaya (Harrisson 1964).

A.2 A blue bead slightly darker than A.1. Comparison of these two should indicate the range of variation between individual beads of one visual "kind" that is certainly high, but of course not random. Comparison with the previous tests should indicate the scale of variation of the different laboratory methods.

A.3 An opaque blue bead that looks exactly like A.1; chosen as one of a long series by three independent observers, without my (more knowledgeable?) intervention. This bead was excavated at Sungei Jaong, Sarawak River delta in 1957 in a China Trade site that dates ca. A.D. 800 to 1000; however, it was almost certainly finished before A.D. 950 (report in press).

A.4 A blue bead, nearly an eye-match for A.3, chosen in the same way from the same site. It will be seen that these two are *fundamentally* different from A.1 and A.2 in lead (PbO), sodium (K_2O) content, etc.

A.5 A pale green bead from the same Jaong site as A.3 and A.4—associated directly with both.

A.6 A bead chosen in exactly the same way and for the same reason as A.3, but from Tanjong Kubor, a headland cemetery at the mouth of the Sarawak River delta excavated in 1955; dated between A.D. 700 and 850 (cf. Tom and Barbara Harrisson 1967 and Wilhelm G. Solheim II 1965).

A.7 A bead from the same Kubor site as A.6, chosen for same reason as A.4.

A.8 A pale green rather than blue bead found with A.6 and A.7 at Kubor (cf. A.5 from Jaong).

A.9 The blue coloring of this bead slightly mottled (rare), but otherwise it is visually close to A.1 and A.2. It is the nearest possible match to the preceding series from Niah Cave, west mouth excavation, at a cave site that can be dated well before A.D. 1000.

A.10 Visually this bead is like A.1, from Kota Batu, Brunei, at 36 in. in horizon; provisionally dated ca. A.D. 1400 (see Tom and Barbara Harrisson 1956).

A.11 Visually, a bead like A.2, but smaller; nearest available eye match from the Painted Cave at Niah; can be dated before A.D. 1100.

A.12 An orange colored tubular bead from Painted Cave (see A.11), unlike rest of series and of a kind still highly valued by upland Kelabits who call it *manik tolang*; similar specimens discussed previously (Harrisson 1964).

B. *Vessel Pieces*

These vessel fragments are rare in West Borneo excavations, unlike West Malaya and the Isthmus of Kra. Nothing similar to Lamb's "punty caps" have been found among many thousands of glass specimens here. The 4 pieces tested were chosen from the limited available material because they appeared to be of glass that resembled broadly the blue or green bead glass of series A.1-A.11 above.

B.1 Fragment from Jaong (see A.3); green with small black spots.

B.2 Flask neck from Kota Batu (see A.10); horizon not exactly dateable, but site finished ca. A.D. 1550.

B.3 Part of glass dish from Kota Batu.

B.4 Another glass dish fragment from Kota Batu; note very high *lead* figure.

C. *Bangles*

These bangles have been the subject of previous discussion by Inez de Beauclair and me (1962). The following series were selected to cover a narrow visual range and relate to the previous remarks and also to cover glass that looks very similar to that used for the beads of series A.1-A.11, above.

C.1 Green bangle from Jaong; of glass type described in A.3.

C.2 Blue bangle from Jaong; of glass type described in A.3.

C.3 Green bangle from Kubor (see A.6); "like" C.1.

C.4 Green bangle from Kota Batu (see A.10); in deep, probably pre-A.D. 1000, level; "like" C.1.

C.5 Green bangle exactly like C.1; found clearing Bintulu airfield with other glass and gold (pre-A.D. 1300).

D-E. *Two Unique Pieces*

D. Piece from a nearly whole fine deep blue vessel found in a T'ang "Cemetery" at Bako, Sarawak River, with John Pope, director of the Freer Gallery, Washington, D.C., in 1957.

E. Piece from a tiny pale green elephant made of glass, excavated at Bukit Maras, Sarawak River delta, and associated loosely with a stone Buddha, an elephant tile in sandstone, and a Tantric Buddhist shrine with golden elephant symbols, all dateable ca. A.D. 1200 or earlier (full report on this and other delta sites in press by S. J. O'Connor and me).

RESULTS

A: BLUE OR GREEN GLASS BEADS*

	A.1	A.2	A.3	A.4	A.5	A.6
	503	504	505	506	507	508
Na_2O	13–16	7–10	8–11	8–11	9–12	12–15
CaO	2.0	3.0	3.0	5.0	8.0	5
K_2O	13.	5.	0.5	0.7	0.6	2.0
MgO	0.2	0.4	2.0	3.0	4.0	4.0
Al_2O_3	0.1	0.1	0.8	1.0	0.8	0.9
Fe_2O_3	0.4	0.4	0.7	0.5	1.1	0.6
TiO_2	....	....	0.08	0.07	0.10	0.03
Sb_2O_5	....	....	....	....	....	....
MnO	.04	....	.16	0.5	1.2	.02
CuO	0.5	0.8	0.07	0.5	....	0.01
CoO	....	....	....	....	....	....
SnO_2	....	....	0.12	....	....	....
Ag_2O	....	....	....	....	.....	....
PbO	15.25	20–30	0.1	....	....	....
BaO	....	....	....	....	....	....
SrO	0.08	0.08	0.05	0.06	0.06	0.08
Li_2O	....	....	....	....	....	0.01
Rb_2O	....	....	....	....	....	....
B_2O_3	....	....	....	....	....	....
V_2O_5	....	....	....	....	....	....
Cr_2O_3	....	....	....	....	0.02	....
NiO	....	....	....	....	0.01	....
ZnO	....	....	....	....	....	....
ZrO	....	....	....	....	....	....
Bi_2O_3	....	0.001	....	....	....	....

* The first number in each column is T.H. reference, the second, the Corning Glass Museum code. The SiO_2 (Silica) total is 100—table results, not shown.

	A.7	A.8	A.9	A.10	A.11	A.12
	509	510	511	512	513	514
Na_2O	15–18	12–15	10–13	8–11	25–30	15–18
CaO	7	6	4	20–25	3	6.0
K_2O	5.0	3.0	3.0	10.0	5.0	0.3
MgO	5.0	4.0	3.0	3.0	0.2	0.8
Al_2O_3	2.0	1.5	1.2	5.0	8.0	10.0
Fe_2O_3	1.8	1.5	0.7	0.3	1.7	1.0
TiO_2	0.07	0.08	0.06	0.10	0.25	0.25
Sb_2O_5	....	....	....	....	....	0.35
MnO	0.3	0.82	1.2	1.0	....	.04
CuO	0.1	0.02	0.5	0.5	0.01	5.0
CoO	0.08	....	....	....	....	....

	A.7	A.8	A.9	A.10	A.11	A.12
SnO_2	....	....	....	0.12	0.07	0.18
Ag_2O	....	....	....	....	....	0.005
PbO	....	0.04	0.02	0.10	0.08	1.0
BaO	0.02	0.02	0.01	....	0.2	0.20
SrO	0.15	0.10	0.07	0.08	0.07	0.20
Li_2O	0.01	0.01	....	0.01	0.02	....
Rb_2O	....	....	....	....	....	....
B_2O_3	0.05	0.07	0.05	....	....	....
V_2O_5	....	....	....	....	0.03	0.03
Cr_2O_3	....	....	....	....	....	....
NiO	....	....	....	....	....	....
ZnO	....	....	....	....	....	....
ZrO_2	....	....	....	....	....	0.5
Bi_2O_3	....	....	....	....	....	....

B: Glass Vessel Pieces

	B.1	B.2	B.3	B.4
	515	516	517	518
Na_2O	12–15	9–12	25–30	0.5
CaO	6.0	9.0	15.0	2.0
K_2O	0.2	0.1	10.0	15–20
MgO	4.0	0.7	3.5	....
Al_2O_3	2.0	0.7	1.0	0.2
Fe_2O_3	0.8	0.5	0.7	0.3
TiO_2	0.25	0.07	0.10	....
Sb_2O_5	....	0.05	....	....
MnO	.06	0.3	.08	....
CuO	....	0.05	....	1.5
CoO	....	0.1	....	....
SnO_2	....	....	....	0.02
Ag_2O	....	....	....	0.02
PbO	0.01	0.5	....	40
BaO	....	0.15	1.0	....
SrO	0.10	....	1.0	....
Li_2O	....	....	....	....
Rb_2O	....	....	....	....
B_2O_3	0.03	....	0.08	....
V_2O_5	....	....	....	....
Cr_2O_3	....	....	....	....
NiO	....	....	....	....
ZnO	....	....	....	1.0
ZrO_2	0.05	....	0.07	....
Bi_2O_3	....	....	....	....

C: GLASS BANGLES

	C.1	C.2	C.3	C.4	C.5
	519	520	521	522	523
Na_2O	17–20	15–18	15–18	13–16	13–16
CaO	10	0.5	1.0	0.1	1.3
K_2O	6.0	15–20	10–13	10–13	4.0
MgO	3.0	0.2	1.0	0.2	2.5
Al_2O_3	1.0	4.0	1.0	2.0	1.0
Fe_2O_3	0.6	0.6	0.5	0.8	0.6
TiO_2	0.10	0.10	0.03	0.30	0.07
Sb_2O_5	....	....	....	....	....
MnO	0.3	0.2	0.6	.01	0.82
CuO	2.5	0.5	....	....	....
CoO	....	....	....	....	....
SnO_2	0.03	....	....	....	....
Ag_2O	....	0.010	....	....	....
PbO	0.05	0.02	....	....	0.02
BaO	0.05	0.05	....	0.02	0.02
SrO	0.5	....	....	....	....
Li_2O	....	....	....	....	....
Rb_2O	....	....	....	....	....
B_2O_3	0.02	....	....	....	....
V_2O_5	....	....	....	....	....
Cr_2O_3	....	....	....	....	....
NiO	....	....	....	....	....
ZnO	0.5	....	....	....	....
ZrO	....	0.03	....	0.05	....
Bi_2O_3	....	....	....	....	....

D-E: Two Unique Pieces

	D.1	E.1
	524	592
Na_2O	14–17	13–16
CaO	1.5	0.2
K_2O	10–13	20–25
MgO	2.5	....
Al_2O_3	0.7	0.8
Fe_2O_3	0.5	0.1
TiO_2	0.05	....
Sb_2O_5	....	0.45
MnO	0.3	....
CuO	0.3	0.3
CoO	....	....
SnO_2	....	....
Ag_2O	....	....
PbO	....	35–40
BaO	0.01	0.17
SrO	....	....
Li_2O	....	....
Rb_2O	....	....
B_2O_3	....	....
V_2O_5	....	....
Cr_2O_3	....	0.01
NiO	....	....
ZnO	....	....
ZrO_2	....	....
Bi_2O_3	....	....

Summary

We still know so little about ancient Asian glass that it would be premature to draw further conclusions from the data, which neither confirm nor disturb the suggestions put forward in earlier papers by Alastair Lamb and me. This study is continuing, and hopefully, the Borneo aspect will be extended considerably with new material excavated on a new control system during 1966, with the continued good will of Corning.

The differences and variations between seemingly similar glasses are apparent. But even if this may seem surprising to ethnologists or artisans who are judging by modern standards, it is not really so. High degrees of variation are to be expected in manufactures using this type of material at those times for the partially "second-class," export-ware market of Borneo.

Fruitful lines for further research in the present direction would seem to include:

1. Further restricted samples—particularly of a visually similar series—analyzed and published to build up sufficient data for fully statistical correlations of variants and initial basic formulas, keeping the issue as simple as possible.

2. Laboratory methods to be of highest quality and to include *every* material present in the glass; trace elements and fractional items may in the end prove to be some of the best clues for distinguishing glasses from different sources.
3. So far as possible, all tested glass to be from:
   a) glass excavated and documented to give at least some time-scale for the earliest or latest possible arrival dates, or both, at the point of find; or
   b) glass found at a proven manufacturing point, a demonstrable workshop where glass was certainly made.

   The correlation of 3*a* and 3*b* can alone provide adequate answers to numerous outstanding questions. We need especially parallel data from China after the Han Dynasty (i.e., Seventh century on).

   It should be added that there is *no* indication that glass beads and bangles were manufactured in West Borneo—and indeed, there is no good reason why it should have been economically wise to produce glass, any more than it would have been wise to make much less transportable stonewares and porcelains with glazes (and these are much *more* abundant than glass in our excavations).

REFERENCES

DE BEAUCLAIR, INEZ
1962 Addenda to 'Ken-Pai': a glass bracelet from Yap. *AP* VI, 1–2: 232–235.

HARRISSON, TOM
1962 Translucent glass rings from Borneo. *AP* VI, 1–2: 236–238.

HARRISSON, TOM
1964 Monochrome glass beads from Malaysia and elsewhere. *M* LXIV: Art. 50: 37–41.

HARRISSON, TOM
1965 The study of beads. *M* LXV: Art. 153: 157.

HARRISSON, TOM and BARBARA
1956 Kota Batu in Brunei. *SMJ* n.s. VII, 8: 283–319.

HARRISSON, TOM and BARBARA
1957 The pre-historic cemetery of Tanjong Kubor. *SMJ* n.s. VIII, 10: 18–50.

LAMB, ALASTAIR
1965 Some glass beads from the Malay Peninsula. *M* LXV: Art. 30: 36–38.

O'CONNOR, S.J., and TOM HARRISSON
1965 Western Peninsula Thailand and West Sarawak: ceramic and statuary comparisons. *SMJ* n.s. XI, 23–24: 562–566.

ORGAN, R.
1965 Review of Earle Caley's "Orchalicum and ancient alloys," *British Museum Quarterly* XXX, 1.

SOLHEIM, W.G. II
1965 The prehistoric earthenware pottery of Tanjong Kubor, Santubong. *SMJ* n.s. XII, 25–26: 1–62.

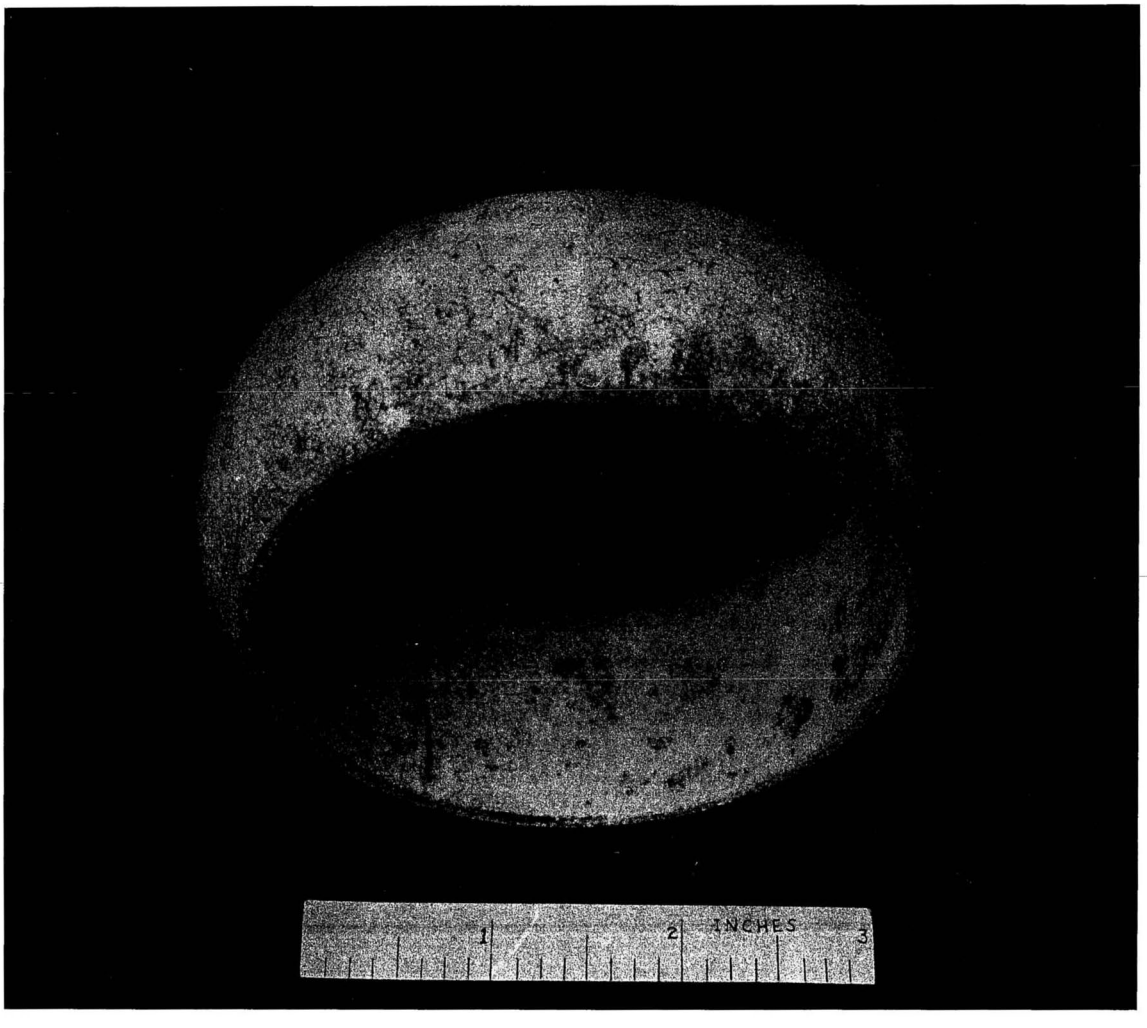

Plate I Bangle of fine porcelainous stoneware found at Kampong Tai'i, Serian District, First Division, Sarawak.